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CONTRACT NAS8-38856

**Structural Damage
Prediction and Analysis
for Hypervelocity Impact**

**BUMPERII Suggestion
and Problem Reports**

Prepared for:
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BUMPERII SUGESTIONS AND PROBLEM REPORTS

FOREWORD

The SD_SURF computer programs and user's guide were prepared under contract NAS8-38856 from NASA Marshall Space Flight Center (MSFC). In the course of preparing the SD_SURF space debris analysis code, several problems and possibilities for improvement of the BUMPERII code were documented and sent to MSFC. These suggestions and problem reports are included here as part of the contract final report.

The study contract (NAS8-38856) title was "Structural Damage Prediction and Analysis for Hypervelocity Impacts." The Technical Monitors were Joel Williamsen, Greg Olsen, and Jennifer Robinson. The code and user's manual were created between October, 1990 and September, 1992.

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Date: January 28, 1992

Subject: **Reducing BUMPERII Memory Requirements**

- Error in Dimensioning *IDG*
- *RESPONSE* Array Size

This describes two changes to **BUMPERII version 1.2.a** which should significantly reduce the memory requirements.


Error in Dimensioning *IDG*

The variable *IDG* is dimensioned improperly in the **DATA** subroutine in **GEOMETRY**. (*IDG* is the working array which contains grid point locations in global coordinates.) It is **INTEGER*4 *IDG*(*IELM*)** but it should be **INTEGER*4 *IDG*(*IELM**4)** to allow for four nodes per element. *IELM*, in **COMMON1.BLK**, is a parameter for the number of elements to be processed. This would be consistent with the dimensioning of the grid point locations, **DIMENSION GRID(3,*IELM**4)**, in the preceding line in **BUMPERII**. (It also may be appropriate to define *GRID* as **REAL*4** for some compilers.) When *IDG* was improperly dimensioned, garbage was being written into other variables if the number of elements in the Supertab file was more than one fourth of *IELM*. **BUMPERII** internal checks found no node data for some elements. It is not known whether there could be any cases the error would not be detected.

RESPONSE Array Size

The *RESPONSE* array was dimensioned as **(70,90,100)** in **COMMON2.BLK** and **COMMON4.BLK**. The 70 is for the number of velocities and is appropriate for the *RESPONSE* output. The 100 is the number of shield *PIDs* being processed. It may need to be 100 for **CONTOUR**, but any number greater than or equal to the *PIDs* in the **Supertab** file will suffice. The only issue is whether the 90 is necessary to cover the obliquities. I believe that the *RESPONSE* subroutine only creates arrays in 5 degree increments which requires a dimension of 19 rather than 90. This will significantly reduce **BUMPERII** memory requirements.

These changes allow **BUMPERII** version 1.2.a to run realistic space debris problems on a Macintosh using 4 Meg of RAM using **LANGUAGE SYSTEMS FORTRAN version 2.1**. (Changes to *If-Then* loops were also included as previously described.) (This was without dynamic memory allocation due to problems encountered in execution. **LS FORTRAN Version 3** may be able to further reduce this size with dynamic memory allocation.) With proper dimensioning *IELM* need only be larger than the number of elements in the Supertab file. **MB17-ALL.UNI** with 2100 elements was processed on the Macintosh with *IELM* set at 2500 rather than 15000 as distributed. The Macintosh version was set for 35 *PIDs* to cover **MB17-ALL.UNI**. The number of threats strongly influences the total memory requirements. To run the above conditions the space debris default of 45 was set as the maximum number of threats. To run a meteoroid analysis on a Macintosh, drastic changes are still needed (such as dynamic memory allocation or virtual memory).


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Program Manager
Hypervelocity Impacts Study

Recommended Changes to BUMPERII Read/Write

Revise READ and WRITE Statements for arrays in binary files in BUMPER, GEOM

- READ or WRITE in a DO-LOOP writes out control information for each record
- READ or WRITE of an array writes out control information once
 - For example READ ((GEOMETRY(I,J),I=1,EXPOSED(IT))J=1,IT)
- Example of a test GEOREAD subprogram on TUBES

	DO-LOOP	Array	Savings
file size on VAX	95 blocks	58 blocks	39%
CPU time to Read	4.58 sec	1.45 sec	variable

- Similar file size savings are available with RESPONSE files
 - File sizes are not as large and therefore not as critical
- A flag could be used to make BUMPERII "downward" compatible
 - For example the 1 or 2 for debris/meteoroid analysis could be written out 3 or 4 to set a flag that the new read and writes are used

Compile Problems with BUMPERII version 1.2a 1/16/92

The following sections show the changes made to BUMPERII Version 1.2.a to allow it to compile and run using LANGUAGE SYSTEMS FORTRAN for the Macintosh.

The array size in the common blocks was reduced to ensure compatability with Macintosh memory limitations. A parameter was introduced in the COMMON4.BLK so that the number of shields would not have to be reentered each time. The entire Common4.blk is attached at the end. It should be noted that the memory manager got confused in RESPONSE when the "-dyn" switch was used for dynamic memory allocation.

The original compile instruction and errors are reported first. The changes to the code to fix these errors is then given. "!!!!" is used to highlight the specific lines or sections which were changed. The only problem was that Language Systems FORTRAN does not support jumping into a DO loop, or IF...THEN...ELSE block. Relatively minor changes to the code could avoid this problem in the future if compatability with Language Systems FORTRAN is desired.

The use of a Line Feed in the output is not needed on the Macintosh and the character was replaced with a space. (Exact change is shown at end.)

Finally, the LIB\$DATE_TIME call on the VAX is different than the Macintosh. This cannot be changed but it is only a minor nuisance.

This is the compile command. The first three switches maximize VAX compatability. The last switch allows the program to run in the background under MULTIFINDER.

```
RUNBIGMACII MacBumperIIv12a -ansi -saveall -u -bkg=2
```

This is the original diagnostics. The corrections will follow.

```
90      READ ( 2,20 )DLINE

Δ
### FORTRAN - A GOTO or IF is Attempting to jump into a DO loop, IF...THEN...ELSE
      or a SELECT CASE block
      File "MacBumperIIv12a.f"; Line 3944
#-----

200    CONTINUE

Δ
### FORTRAN - A GOTO or IF is Attempting to jump into a DO loop, IF...THEN...ELSE
      or a SELECT CASE block
      File "MacBumperIIv12a.f"; Line 4360
#-----

600      IF (IBOTHR.EQ.2) PENTABFILE=SPENTFILE(IC)

Δ
### FORTRAN - A GOTO or IF is Attempting to jump into a DO loop, IF...THEN...ELSE
      or a SELECT CASE block
      File "MacBumperIIv12a.f"; Line 5054
#-----

### MPW Shell - Execution of RUNBIGMACII7000 terminated.
```

THE FOLLOWING SECTIONS SHOW THE CHANGES MADE TO BUMPERII VERSION 1.2.A
TO ALLOW IT TO COMPILE USING LANGUAGE SYSTEMS FORTRAN FOR THE MACINTOSH.

File "MacBumperIIv12a.f"; Line 3944

```

C
C 90      READ ( 2,20 )DLIN
C !!!! THE ABOVE WAS COMMENTED OUT AND REPEATED WITHOUT THE 90
C !!!! THIS SECTION IS THE REPEATED BELOW (OUT OF IF-BLOCK) WITH THE 90
      READ ( 2,20 )DLIN
      READ ( DLIN(1:6),30,ERR=90,END=100 )IVAL
      IF ( IVAL.NE.-1 ) GO TO 90
      GO TO 10

C
      END IF

C
      END IF
C !!!! MAC VERSION: THIS SECTION IS REPEATED FROM ABOVE WITH THE 90
90      READ ( 2,20 )DLIN
      READ ( DLIN(1:6),30,ERR=90,END=100 )IVAL
      IF ( IVAL.NE.-1 ) GO TO 90
      GO TO 10

```

File "MacBumperIIv12a.f"; Line 4360

```

      CALL INPUT R (CTYPE,IC,ITYPE,MLI,PFUNC,PFunc1,IMat,
1      SHTHK,STAND,VWTHK,BHARD,C,DENS,FSU,FTU,FY,SHPV,WILKC,
2      SMATRL,METRIC,SCType,SavTk,SMLI,ShDen,VWDen,IDens,
3      INTERP DIAM,THICK,ANGLE,ADEN,ADAR,MODWILK,IBOTHR,
4      WILKMULT,SMODWILK,SWILKMULT,SPUNC,SIMAT,SPENTFILE,
5      PID,LASTPID)

C
C !!!! THE FOLLOWING LINE WAS CHANGED FROM 200 TO 201 AND 201 IS
C      ADDED LATER FOR MAC COMPATABILITY
      IF(IBATCOM.EQ.1) GOTO 201

C
      IF (IBOTHR.EQ.2.AND.IC.EQ.1) THEN
...
...
      ENDIF

C
      Convert the diameter to cm
      DIAM = DIA * 2.54

C
      Store the diameter in RTABLE
      RTABLE(J,I,IC)=DIAM

100      CONTINUE
200      CONTINUE
C !!!! THE FOLLOWING LINE WAS ADDED FOR MAC COMPATBAILITY
201      CONTINUE

C
C      SKIP IF SECOND PASS DURING A COMBINED RUN

```

```

File "MacBumperIiv12a.f"; Line 5054
C THE FOLLOWING SECTION WAS DONE BY BJORKMAN & CO. (WP-01).
C
      IF(PFUNC.NE.5)GO TO 145
      GOTO 143
144      WRITE(6,151)
151      FORMAT( /,' UNABLE TO OPEN PENETRATION FILE')
143      PENTABOLD=PENTABFILE//'. '
      IF (INDEX(PENTABOLD,'.').LT.2) PENTABFILE='PEN.TAB'
      JOT = INDEX( PENTABFILE,'.')
      WRITE (LENGTH, '(I2)' ) JOT+3
      FORM='(/1X,'PENETRATION TABLE FILENAME <CR='',A'//LENGTH//
      .',') > ','$)'
      PENTABOLD=PENTABFILE
149      WRITE(6,FORM) PENTABFILE
      READ ( 5,'(A)',ERR=143 ) ANSWER
      IF (ANSWER(1:1).EQ.'?') THEN
          CALL DIRLIST
          GOTO 149
      END IF
      IF ( ANSWER(1:4).EQ.' ' ) THEN
          PENTABFILE=PENTABOLD
      ELSE
          READ ( ANSWER(1:80),'(BN,A)',ERR=143 ) PENTABFILE
      END IF
C !!!! 600 WAS DELETED FROM THE FOLLOWING LINE AND THE ENTIRE SECTION
C      IS REPEATED OUTSIDE OF THE IF BLOCK FOR MACINTOSH COMPATABILITY
      IF (IBOTHR.EQ.2) PENTABFILE=SPENTFILE(IC)
      Open (Unit=20,file=pentabfile,status='old',ERR=144)
      IF(IBATCOM.EQ.1.AND.IBOTHR.NE.2) THEN
          WRITE(13,'(A)') PENTABFILE
          GOTO 146
      END IF
C   ANGLE INDICE
      Do 146 I=1,3
C   PLATE THICKNESS INDICE IN INCHES.
      Do 147 J=1,4
          Read (20,*) Thick(J),Angle(I)
C   VELOCITY INDICE IN INCHES
      Do 148 K=1,7
          Read (20,*) Interp_Diam(K,J,I)
148      CONTINUE
147      CONTINUE
146      CONTINUE
      REWIND 20
      Close (Unit=20)
145      CONTINUE
C
C THE ABOVE SECTION WAS DONE BY BJORKMAN & CO. (WP-01).
C
      IF (IBOTHR.EQ.2) GOTO 425
C
C   Determine the shield material.
C
150      WRITE ( 6,160 )
160      FORMAT (/1X,'SHIELD MATERIAL ')
C
C   Write out the material list.

```

```

C
DO 180 I=1,ML
C
    WRITE ( 6,170 ) I,MATERIAL(I)
170    FORMAT ( 3X,I2,'- ',A )
C
180    CONTINUE
C
    For the initial case, set the material default number equal to one.
    For all other cases use the previous shield material number as the
    default. If an error is detected on the read, repeat the process.
C
    IF ( IC .EQ. 1 ) THEN
190        WRITE ( 6,220 )
        READ ( 5,'(A)' ) ANSWER
        IF ( ANSWER(1:4).EQ.' ')ANSWER='1'
        READ (ANSWER(1:4),200,ERR=190)MATIN
200        FORMAT(BN,I4)
    ELSE
        IF (MATIN.EQ.0) MATIN=1
210        WRITE ( 6,230 ) MATIN
        READ ( 5,'(A)' ) ANSWER
        IF (ANSWER(1:4).NE.' ') THEN
            READ ( ANSWER(1:4),200,ERR=210 ) MATIN
        END IF
    ENDIF
    MAT(1)=MATIN
220    FORMAT (1X,'SELECT MATERIAL NUMBER (<CR>=1) > ', $)
230    FORMAT (1X,'SELECT MATERIAL NUMBER (<CR>=',I2,') > ', $)
C
    Check that the value read in is contained in the list.
C
    IF ( MAT(1) .LT.1 .OR. MAT(1).GT. ML ) GO TO 150
    IF(IBATCOM.EQ.1) WRITE(13,'(I1)') MAT(1)

    SMATRL(IC,1) = MATERIAL ( MAT(1) )
C
    Determine the shield thickness. For the initial case there is no default,
    for all other cases use the previous value as the default.
C
    IF ( IC.EQ.1.OR.SHTHK.LT.0. ) THEN
240        WRITE ( 6,270 )LUNITS
        READ ( 5,*,ERR=240 ) SHTHKIN
    ELSE
250        WRITE ( 6,280 ) SHTHKIN,LUNITS
        READ ( 5,'(A)' ) ANSWER
        IF ( ANSWER(1:4).NE.' ') THEN
            READ ( ANSWER(1:12),260,ERR=250 ) SHTHKIN
260        FORMAT(BN,E12.0)
        END IF
    END IF
270    FORMAT ( /1X,'SHIELD THICKNESS (' ,A,') = > ', $)
280    FORMAT ( /1X,'SHIELD THICKNESS <CR> = ',F10.5,'(' ,A,') > ', $)
    IF (IBATCOM.EQ.1) WRITE(13,*) SHTHKIN
C
    END IF
C
    Determine the vessel wall material. Use the same technique as used

```

```

C      to determine the shield material.
C
290 IF (CTYPE.EQ.1.AND.IMAT.NE.1) GOTO 339
    WRITE ( 6,300 )
300 FORMAT (/1X,'VESSEL WALL MATERIAL ' )
C
    IF ( CTYPE.EQ.1 ) MAT(1) = 1
C
    DO 310 I=1,ML
        WRITE ( 6,170 ) I,MATERIAL(I)
310 CONTINUE
C
    IF ( IC.EQ.1 ) THEN
320    WRITE ( 6 ,220 )
        READ ( 5,'(A)' ) ANSWER
        IF ( ANSWER(1:4) .EQ. ' ' ) ANSWER='1'
        READ ( ANSWER (1:4),200,ERR=320 ) MAT(2)
    ELSE
330    WRITE ( 6,230 ) MAT(2)
        READ ( 5,'(A)' ) ANSWER
        IF ( ANSWER(1:4).NE.' ' ) THEN
            READ ( ANSWER(1:4),200,ERR=330 )MAT(2)
        END IF
    END IF
C
    IF ( MAT(2).LT.1 .OR. MAT(2).GT.ML ) GO TO 290
    IF (IBATCOM.EQ.1) WRITE(13,'(I1)') MAT(2)

    SMATRL(IC,2) = MATERIAL ( MAT(2) )
C
C      Determine the vessel wall thickness.
C
339 IF ( IC .EQ. 1 ) THEN
340    WRITE ( 6,360 )LUNITS
        READ ( 5,*,ERR=340 ) VWTHKIN
    ELSE
350    WRITE ( 6,370 ) VWTHKIN,LUNITS
        READ ( 5,'(A)' ) ANSWER
        IF ( ANSWER(1:4).NE.' ' ) THEN
            READ (ANSWER(1:12),260,ERR=350) VWTHKIN
        END IF
    END IF
360 FORMAT (/1X,'VESSEL WALL THICKNESS (' ,A,') = > ', $)
370 FORMAT (/1X,'VESSEL WALL THICKNESS <CR> = ',F10.5,'(' ,A,') > ', $)
    IF (IBATCOM.EQ.1) WRITE(13,*) VWTHKIN
C
    IF ( CTYPE.NE.1 ) THEN
C
C      Determine the shield stand-off distance.
C
    IF ( IC.EQ.1 ) THEN
380    IF (CTYPE.EQ.3) THEN
        WRITE ( 6,371 )LUNITS
    ELSE
        WRITE ( 6,400 )LUNITS
    END IF
    READ ( 5,*,ERR=380 ) STANDIN
    ELSE

```

```

390     IF (CTYPE.EQ.3) THEN
          WRITE ( 6,381 ) STANDIN,LUNITS
        ELSE
          WRITE ( 6,410 )STANDIN,LUNITS
        END IF
        READ ( 5,'(A)' ) ANSWER
        IF ( ANSWER(1:4).NE.' ' ) THEN
          READ ( ANSWER(1:12),260,ERR=390 ) STANDIN
        END IF
      END IF
371     FORMAT ( /1X,'TOTAL BUMPER SPACING (' ,A,' ) = > ' , $ )
400     FORMAT ( /1X,'SHIELD STAND-OFF (' ,A,' ) = > ' , $ )
381     FORMAT ( /1X,'TOTAL BUMPER SPACING <CR> = '
          ,F10.5,'(' ,A,' ) > ' , $ )
410     FORMAT ( /1X,'SHIELD STAND-OFF <CR> = ' ,F10.5,'(' ,A,' ) > ' , $ )
          IF (IBATCOM.EQ.1) WRITE(13,*) STANDIN

C
C     Determine if MLI is to be included, but not for the pen4 penetration
C     function
C
          IF ( PFUNC.EQ.1.OR.PFUNC.EQ.3.OR.PFUNC.EQ.4 ) THEN
C
          WRITE ( 6,420 )
420     FORMAT (/1X,'INCLUDE 30 LAYERS OF MLI AGAINST VESSEL WALL',
1         ' (<CR>=YES) > ' , $ )
          READ ( 5,'(A)' )ANSWER
          IF ( ANSWER(1:4).EQ.' ' ) ANSWER='Y'
          IF (IBATCOM.EQ.1) THEN
            WRITE(13,'(A)' ) ANSWER
            RETURN
          END IF
          IF ( ANSWER(1:1).EQ.'Y'
1          .OR. ANSWER(1:1).EQ.'y' ) THEN
            MLI=.TRUE.
          ELSE
            MLI=.FALSE.
          END IF

          END IF
        END IF

C
C     !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
C     THE FOLLOWING SECTIONS WERE EXTRACTED FROM ABOVE IF-BLOCK
C     FOR MAC COMPATABILITY. - N.ELFER
C
          GOTO 425
644     WRITE(6,651)
651     FORMAT( /,' UNABLE TO OPEN PENETRATION FILE')
643     PENTABOLD=PENTABFILE//'.'
          IF (INDEX(PENTABOLD,'.').LT.2) PENTABFILE='PEN.TAB'
          JOT = INDEX( PENTABFILE,'.')
          WRITE (LENGTH, '(I2)' ) JOT+3
          FORM='(/1X,'PENETRATION TABLE FILENAME <CR>=' ,A'//LENGTH//
          .',' ) > ' , $ )'
          PENTABOLD=PENTABFILE
649     WRITE(6,FORM) PENTABFILE
          READ ( 5,'(A)',ERR=643 ) ANSWER
          IF (ANSWER(1:1).EQ.'?') THEN

```

```

        CALL DIRLIST
        GOTO 649
    END IF
    IF ( ANSWER(1:1).EQ.' ' ) THEN
        PENTABFILE=PENTABOLD
    ELSE
        READ ( ANSWER(1:80),'(BN,A)',ERR=643 ) PENTABFILE
    END IF
600    IF (IBOTHR.EQ.2) PENTABFILE=SPENTFILE(IC)
    Open (Unit=20,file=pentabfile,status='old',ERR=644)
    IF (IBATCOM.EQ.1.AND.IBOTHR.NE.2) THEN
        WRITE(13,'(A)') PENTABFILE
        GOTO 646
    END IF
C   ANGLE INDICE
    Do 646 I=1,3
C   PLATE THICKNESS INDICE IN INCHES.
    Do 647 J=1,4
        Read (20,*) Thick(J),Angle(I)
C   VELOCITY INDICE IN INCHES
    Do 648 K=1,7
        Read (20,*) Interp_Diam(K,J,I)
648    CONTINUE
647    CONTINUE
646    CONTINUE
    REWIND 20
    Close (Unit=20)
645    CONTINUE
C
C THE ABOVE SECTION WAS DONE BY BJORKMAN & CO. (WP-01).
C
C THE ABOVE SECTION WAS REPEATED FOR MAC COMPATABILITY
C 1XX WAS CHANGED TO 6XX (600 STAYED THE SAME) - N.ELFER
C !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

```

```

TO AVOID A NON-PRINTING CHARACTER IN THE MAC OUTPUT THE FOLLOWING
CHANGE WAS MADE.
C   DS=CHAR(10)
C !!!!! DS WAS CHANGED FROM CHAR(10)=LF TO (32)=SPACE
        DS=CHAR(32)

```

```

DUE TO DIFFERENCES IN THE LIBRARY CALL THE FOLLOWING CHANGES WERE MADE AS
NEEDED (3 PLACES):
C   CALL LIB$DATE_TIME(BUMDTTM)
C !!!!! DATE ONLY RECORDED FOR MAC VERSION
        CALL DATE(BUMDTTM)
        or
        CALL TIME(BUMDTTM)

```

THIS IS THE REVISED COMMON4.BLK TO SET THE SIZE OF THE THREAT ARRAYS:

```

C
C Common Block for Response in BUMPERII
C

```

```

C  icase = maximum number of shield cases
C
C      INTEGER*4 ICASE
      PARAMETER (ICASE=3)
C
C
C      CHARACTER*30 OFILE1, OFILE2, MATFILE
      CHARACTER*80 ANSWER
      CHARACTER*12 UNITS, SMATRL(ICASE,2)
      REAL*4 RTABLE(70,90,ICASE), WILKMULT
C  WAS      50 - MAC
      REAL*4 SAVTK(ICASE,3), SHDEN(ICASE), VWDEN(ICASE)
      REAL*4 BHARD(3), C(3), DENS(3), FSU(3), FTU(3), FY(3), SHPV(3),
1          WILKC(3), ANGLE(3), INTERP_DIAM(7,4,3),
2          ADAR(ICASE)

      INTEGER*4 CTYPE, IC, ITYPE, NANG, NVEL, PFUNC, PFUNC1, SCTYPE(ICASE),
1          IDENS, IBATCOM, IYPEIN, MODWILK, IBOTHR

      LOGICAL INITIAL, METRIC, MLI, SMLI(ICASE)
C      COMMON /BATCH/IBATCOM, IBOTH

C Common Block for PEN_4 Subroutine of BUMPERII
C
      CHARACTER SHAPE*3
      LOGICAL PENNON, SHATER
      INTEGER MAXK(10), PRMAT, PRMAT1, TARMAT(10), TMATSP(10), PLATE,
1          BIN, NBIN, I
      REAL RF(10), RC(10), NF, J, MR, MPROJ, LASTSP, LRM, FRMASS(10),
1          DIAM, VI, VR, VILRM, VRLRM, EPSIL, GAMMA, VII, PI, THETA, SUMSP,
1          A, B, D, R, X, Y, TOVERD, RH, PLATEM, FTHETA, ALLMAS, VC, DELJ, DELJ2,
1          P, EFFP, PET, PGRADY, THETA1, AVGMAS, RP, F1, VF, THICK(10), SPACE(9),
1          THICK1(10), PDENSE(3), PYSTRN(3), PSONDV(3), FRTUFF(3),
1          VIX, MRMAX, MPROJX, DENSE(10)
      DOUBLE PRECISION INTACT, HOAREA, SUMPR(10), NR, PCR, LAMBDA, SIGSQ,
1          SIGMA, AS, AC, THETAR

```


Hypervelocity Impact Study - BUMPERII Suggestions

To: Greg Olsen NASA-MSFC ED52
Scott Hill NASA-MSFC ED52

Date: May 19, 1992

From: Norman Elfer
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Subject: BUMPERII compatability problems with Language Systems FORTRAN

A problem was discovered using the REGRESSION option of RESPONSE on the Macintosh. The problem did not occur on the VAX. It occurred because of inconsistent variable data types when calling a subroutine.

The subroutine SETBIN called the subroutine BINOMI:

```
CALL Binomi(k,Nl,Pk,Pl)
```

The variable "k" was INTEGER*2 in SETBIN. The others were REAL*8.

The BINOMI subroutine received k1 as REAL*8. The original line was:

```
SUBROUTINE Binomi(k1,NrBIN,Pk,PcrBIN)
```

where "k1" was declared as REAL*8 in the subroutine. (All of the variables were REAL*8 in the subroutine.) However, on the Macintosh, using Language Systems FORTRAN, this lack of agreement left "k1" with a value of 3.1...E-310. While this was effectively zero, BINOMI was very sensitive to the differences and produced erroneous results.

A work around was devised:

The subroutine was changed to introduce an integer*2 dummy variable. The dummy variable could then be properly transformed to a REAL*8:

```
SUBROUTINE Binomi(kintbin,NrBIN,Pk,PcrBIN)
...
integer*2 kintbin
...
k1=kintbin*1.0D0
```

This works and will be incorporated in the Macintosh version. Other potential changes in the BINOMI subroutine include:

- Deleting LAMBDABIN since it is not used.
- Defining LOWER1 and KB as INTEGER*2 instead of REAL*8
- Deleting LAMBDA in COMMON.BLK since it is not used. (It was left over from version 1.2)
- The following line seems to be in error:

```
3060      IF (Top.GE.NrBIN.OR.Pk.GE.1E23) GOTO 3050
```

Pk is a probability and should never exceed 1.0. The comparison to 1E23 seems to be incorrect. Perhaps 1E-3? All in all it seems irrelevant to the cases encountered under the REGRESSION subroutine.

To determine if this problem exists in other subroutines, the FORTRAN-lint program was run. It identified one other location where different variable types were used in calling and running a subroutine. This will also have to be fixed for the Language Systems FORTRAN compiled code to operate correctly. The entire LINT output is included for reference since it may be of use in cleaning up BUMPERII.

Norman Elfer 5/19/92
(504)-863-2284

Hypervelocity Impact Study - BUMPERII Suggestions

FORTTRAN-lint Rev 2.83

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Options: /SUPPRESS=(76,276,261,207,219)/FYI/GLOBAL/IMPLICIT/SPLIT=bumpii.diag/STATISTICS/SUMMARY

Directory MMC\$DISK01:[ELFER]

BUMPERII.FOR;1

```
*****
      Program BUMPER                      File BUMPERII.FOR          Line 1
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
      Subroutine BATCHCOM                  File BUMPERII.FOR          Line 105
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
      Subroutine INPUT_B                   File BUMPERII.FOR          Line 247
>          READ ( IU, '(A)',ERR=255 ) DLINE
>          ^
BUMPERII.FOR:INPUT_B line 332:
SYNTAX WARNING #46- branch into block if via label 255.
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
      Subroutine COMTEXT                   File BUMPERII.FOR          Line 450
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  10
*****
      Subroutine GEOMETRY                  File BUMPERII.FOR          Line 478
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
      Subroutine ZERO_G                   File BUMPERII.FOR          Line 789
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
      Subroutine HEADER                   File BUMPERII.FOR          Line 805
>          IF (OFILE(1:3).EQ.'  ') OFILE=ANSWER
>
BUMPERII.FOR:HEADER line 1150:
SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  150
*****
```

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Subroutine INPUT_G File BUMPERII.FOR Line 1220

> 179 READ (ANSWER(1:80),215,ERR=206) AREAMAX

>^

BUMPERII.FOR:INPUT_G line 1443:

SYNTAX WARNING #46- branch into block if via label 206.

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine MAKETHREAT File BUMPERII.FOR Line 1465

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine DTHREAT_SUB File BUMPERII.FOR Line 1490

> 43 VELFILEOLD=VELFILE//'. '

>^

BUMPERII.FOR:DTHREAT_SUB line 1651:

SYNTAX FYI #105- string will be truncated (from 51 to 50 chars).

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

SYNTAX FYI #138- unused labels: 290, 200

Subroutine NDTHREAT File BUMPERII.FOR Line 1848

> CALL GAUSS (PRV,V1,V2,PROB)

>^

BUMPERII.FOR:NDTHREAT line 2098:

INTERFACE ERROR #55- R*8 actual arg passed to a R*4 dummy arg.

USAGE WARNING #127- local variables set but never referenced: H (Line 2061)

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, CHRUMMY, I1,
I2, VDISTA, C1, C2, C3,
C4, VBEG, VEND

SYNTAX FYI #138- unused labels: 290

Subroutine GAUSS File BUMPERII.FOR Line 2141

IMPLICIT #125- symbols were implicitly typed:
(R*4) FUN

Function PRV File BUMPERII.FOR Line 2173

USAGE ERROR #126- local variables referenced but never set: H (Line 2181)

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, CHRUMMY

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Subroutine NMTHREAT File BUMPERII.FOR Line 2188

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY,
RESF

Subroutine MTHREAT File BUMPERII.FOR Line 2455

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY,
ALTA, HNMT, RESF

Subroutine NORMAL File BUMPERII.FOR Line 2716

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine BREAKER File BUMPERII.FOR Line 2823

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, H, CHRUMMY

Subroutine JOINER File BUMPERII.FOR Line 2873

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine DIVIDE4 File BUMPERII.FOR Line 2907

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, H, CHRUMMY

Subroutine DIVIDE3 File BUMPERII.FOR Line 2975

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine CENTROID File BUMPERII.FOR Line 3104

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine INTERSEC File BUMPERII.FOR Line 3210

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine AREA_SUB File BUMPERII.FOR Line 3338

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine WRITEAREA File BUMPERII.FOR Line 3454

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

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```
*****
Subroutine RADIUS                               File BUMPERII.FOR      Line 3490
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine BACKSIDE                             File BUMPERII.FOR      Line 3575
USAGE ERROR #126- local variables referenced but never set:  TR (Line 3791)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine TRANS                               File BUMPERII.FOR      Line 3814
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine QSORT                              File BUMPERII.FOR      Line 3915
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine SHADOW                             File BUMPERII.FOR      Line 4068
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, H, CHRUMMY
*****
Subroutine OUTPUT                             File BUMPERII.FOR      Line 4433
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine ROTATOR                            File BUMPERII.FOR      Line 4497
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DATA                              File BUMPERII.FOR      Line 4561
> 90      READ ( 2,20 )DLIN
> ^
BUMPERII.FOR:DATA line 4790:
SYNTAX WARNING #53- branch to label 90 from outside block if.
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine PATOUT                             File BUMPERII.FOR      Line 4907
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY,
VERS
*****
Subroutine RESPONSE                           File BUMPERII.FOR      Line 4992
```

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```
> 200 CONTINUE
> ^
```

BUMPERII.FOR:RESPONSE line 5347:

SYNTAX WARNING #54- branch to label 200 from outside do loop.

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

[illegible]

USAGE WARNING #127- local variables set but never referenced: EL (Line 5433), H (Line 5439)

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, CHRUMMY

```
*****  
Subroutine INITANGVEL                      File BUMPERII.FOR          Line 5497
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

[illegible]

```
> OFILE1=ANSWER
>      ^
```

BUMPERII.FOR:OPENRSP line 5560:

SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).

```
> IF (OFILE2(1:4).EQ.' ') OFILE2=ANSWER
> ^
```

BUMPERII.FOR:OPENRSP line 5597:

SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

[illegible]

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY

[illegible]

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

[illegible]

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

```
*****
Subroutine INPUT_R_MATRL          File BUMPERII.FOR          Line 6026
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

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```

*****
Subroutine INPUT_R_UNITS                      File BUMPERII.FOR          Line 6095
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_R_CONFIG                    File BUMPERII.FOR          Line 6148
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine SPINPUT_R                        File BUMPERII.FOR          Line 6204
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DPINPUT_R                        File BUMPERII.FOR          Line 6330
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_R_GETPENTAB                File BUMPERII.FOR          Line 6449
> 143  PENTABOLD=PENTABFILE//'. '
>      ^
BUMPERII.FOR:INPUT_R_GETPENTAB line 6458:
SYNTAX FYI #105- string will be truncated (from 51 to 50 chars).

>148      CONTINUE
>      ^
BUMPERII.FOR:INPUT_R_GETPENTAB line 6507:
SYNTAX WARNING #54- branch to label 148 from outside do loop.

>146      CONTINUE
>      ^
BUMPERII.FOR:INPUT_R_GETPENTAB line 6509:
SYNTAX WARNING #54- branch to label 146 from outside do loop.

USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  145

*****
Subroutine INPUT_R_WILK                      File BUMPERII.FOR          Line 6522
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine MWINPUT_R                        File BUMPERII.FOR          Line 6630
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine MWINPUT                          File BUMPERII.FOR          Line 6693
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****

```


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```
*****
Subroutine INPUT_R_VW                      File BUMPERII.FOR          Line 6788
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_R_SHIELD                  File BUMPERII.FOR          Line 6923
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  180
*****
Subroutine INPUT_R_STAND                   File BUMPERII.FOR          Line 7076
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_R_MLI                     File BUMPERII.FOR          Line 7143
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_R_VARS                    File BUMPERII.FOR          Line 7187
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine SETMETRICS                     File BUMPERII.FOR          Line 7336
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_R_OUT                     File BUMPERII.FOR          Line 7369
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DOUBLE                          File BUMPERII.FOR          Line 7590
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
USAGE WARNING #245- local variables may be referenced before set:  C2 (Line 7752), DIAM2 (Line 7753),
DIAM4 (Line 7780), ERFIL (Line 7766)
*****
Subroutine BALLIST                         File BUMPERII.FOR          Line 7851
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
USAGE WARNING #245- local variables may be referenced before set:  DIA1 (Line 7994), DIA2 (Line 7994),
VEL1 (Line 7994), VEL2 (Line 7994)
*****
Subroutine MLIADJUST                       File BUMPERII.FOR          Line 8021
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
```

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```
*****
Subroutine COURPAL                      File BUMPERII.FOR      Line 8052
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine GLASS                      File BUMPERII.FOR      Line 8147
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine TILE                      File BUMPERII.FOR      Line 8210
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine SPDEVEL2                  File BUMPERII.FOR      Line 8271
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine BRISTOW                  File BUMPERII.FOR      Line 8283
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
USAGE WARNING #245- local variables may be referenced before set:  PLP1 (Line 8401), DIAL (Line 8401)
*****
Subroutine WILKIN                   File BUMPERII.FOR      Line 8475
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine REGRESS                  File BUMPERII.FOR      Line 8595
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine OPEN4                   File BUMPERII.FOR      Line 8729
USAGE WARNING #127- local variables set but never referenced:  SMALL (Line 8751), RECIPSQRT2PI (Line 8752)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, NH,
NR2, NHT, LASTPK,
EXPONENT, TOPCOUNT, BOTTOMCOUNT1, BOTTOMCOUNT2, SPACING, SOUNDVEL, THETDIAM, SHOCKPROJVEL,
HARDNESS, EPSILO4
*****
Subroutine FRACT                   File BUMPERII.FOR      Line 8814
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine LARMR                   File BUMPERII.FOR      Line 8828
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
```

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```
*****
Subroutine MASSERR                      File BUMPERII.FOR      Line 8843
USAGE ERROR #126- local variables referenced but never set:  THETA (Line 8855)
USAGE FYI #128- local variables declared but unused:  THOS
*****
Subroutine PEN4                        File BUMPERII.FOR      Line 8864
USAGE WARNING #127- local variables set but never referenced:  DIA2 (Line 9061), VEL2 (Line 9063)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY
USAGE WARNING #245- local variables may be referenced before set:  DIA1 (Line 9061), VEL1 (Line 9063)
*****
Subroutine NPEN4                      File BUMPERII.FOR      Line 9075
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY
*****
Subroutine PENK                      File BUMPERII.FOR      Line 9409
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY,
PK2, LNPk, LNKFAC
*****
Subroutine MINII                     File BUMPERII.FOR      Line 9484
USAGE FYI #128- local variables declared but unused:  BINSO
*****
Subroutine PRS                      File BUMPERII.FOR      Line 9499
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY
USAGE WARNING #245- local variables may be referenced before set:  LASTTE (Line 9520)
*****
Subroutine SETBIN                    File BUMPERII.FOR      Line 9556
>      CALL Binomi(k,N1,Pk,P1)
>      ^
BUMPERII.FOR:SETBIN line 9572:
INTERFACE ERROR #55- I*2 actual arg passed to a R*8 dummy arg.
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY
*****
Subroutine BINOMI                    File BUMPERII.FOR      Line 9584
USAGE WARNING #127- local variables set but never referenced:  LAMBDA BIN (Line 9590)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDRUMMY
*****
```

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```
*****
Subroutine MASCHR                      File BUMPERII.FOR      Line 9632
USAGE ERROR #126- local variables referenced but never set:  ALFA (Line 9662)
USAGE WARNING #127- local variables set but never referenced:  FRGLIM (Line 9670)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, TD
*****
Subroutine SHCONS                      File BUMPERII.FOR      Line 9720
USAGE ERROR #126- local variables referenced but never set:  ALPHA (Line 9724)
*****
Subroutine SHHOLD                      File BUMPERII.FOR      Line 9768
USAGE FYI #128- local variables declared but unused:  M
USAGE FYI #124- unused dummy arguments:  VI, TD, THETA1
*****
Subroutine BINLIM                      File BUMPERII.FOR      Line 9791
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY,
BININT
*****
Subroutine COUNTR                      File BUMPERII.FOR      Line 9841
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
USAGE WARNING #245- local variables may be referenced before set:  ITARS1 (Line 9907), DIGTP1 (Line 9906),
DIGTP2 (Line 9910),
DIGTP3 (Line 9911), DIGTP4 (Line 9912), DIGTP5 (Line 9913)
BUMPERII.FOR:COUNTR line 9855:
INTERFACE FYI #121- common block /COUNT/ member names differ (compared to initial use in routine PENK).
*****
Subroutine RESVEL                      File BUMPERII.FOR      Line 9978
USAGE FYI #128- local variables declared but unused:  VOCM
*****
Subroutine INTERP                      File BUMPERII.FOR      Line 10037
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INTERPOLATE                  File BUMPERII.FOR      Line 10071
USAGE WARNING #245- local variables may be referenced before set:  NSAV (Line 10106)
*****
Function HS3TBL                        File BUMPERII.FOR      Line 10113
USAGE FYI #128- local variables declared but unused:  HSMCON, SUBNAM
*****
```

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```
*****
Subroutine RICHARDSON                      File BUMPERII.FOR      Line 10317
USAGE WARNING #127- local variables set but never referenced:  E1 (Line 10343)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, RHP
*****
Subroutine DEVELOPMENTAL7                  File BUMPERII.FOR      Line 10485
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL8                  File BUMPERII.FOR      Line 10546
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL9                  File BUMPERII.FOR      Line 10609
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL10                 File BUMPERII.FOR      Line 10672
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL11                 File BUMPERII.FOR      Line 10735
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL12                 File BUMPERII.FOR      Line 10798
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL13                 File BUMPERII.FOR      Line 10861
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL14                 File BUMPERII.FOR      Line 10924
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL15                 File BUMPERII.FOR      Line 10987
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine DEVELOPMENTAL16                 File BUMPERII.FOR      Line 11050
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
```

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Subroutine MULTISHOCK File BUMPERII.FOR Line 11113

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
USAGE WARNING #245- local variables may be referenced before set: ERFILE (Line 11177)

Subroutine MESH File BUMPERII.FOR Line 11273

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, TSOD

USAGE WARNING #245- local variables may be referenced before set: ERFILE (Line 11341)

Subroutine HYBRID_MS File BUMPERII.FOR Line 11427

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine MWDEVELOPMENTAL1 File BUMPERII.FOR Line 11530

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine MWDEVELOPMENTAL2 File BUMPERII.FOR Line 11542

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine MWDEVELOPMENTAL3 File BUMPERII.FOR Line 11555

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine SINGLE File BUMPERII.FOR Line 11567

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine SPDEVEL1 File BUMPERII.FOR Line 11639

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

Subroutine NONOPTIMUM File BUMPERII.FOR Line 11651

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

USAGE WARNING #245- local variables may be referenced before set: ERFILE (Line 11721)

Subroutine NEWNONOPTIMUM File BUMPERII.FOR Line 11808

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

USAGE WARNING #245- local variables may be referenced before set: ERFILE (Line 11883)

```

*****
Subroutine SHIELD                               File BUMPERII.FOR          Line 11969
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  314

*****
Subroutine ZERO_S                               File BUMPERII.FOR          Line 12327
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

*****
Subroutine SETDIAMS                             File BUMPERII.FOR          Line 12342
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

*****
Subroutine LASTOUT                             File BUMPERII.FOR          Line 12369
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H

*****
Subroutine HEADER_S                             File BUMPERII.FOR          Line 12557
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

*****
Subroutine INPUT                               File BUMPERII.FOR          Line 12745
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY,
ALTMAX, ALTMIN
SYNTAX FYI #138- unused labels:  365

*****
Subroutine GEOREAD                             File BUMPERII.FOR          Line 13147
>      GFILE=ANSWER
>      ^
BUMPERII.FOR:GEOREAD line 13203:
SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, ITF
SYNTAX FYI #138- unused labels:  56

*****
Subroutine RESREAD                             File BUMPERII.FOR          Line 13413
>      RFILE=ANSWER
>      ^
BUMPERII.FOR:RESREAD line 13468:
SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).
USAGE WARNING #127- local variables set but never referenced:  C8A (Line 13639), C8B (Line 13639), D2
(Line 13653)
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY

```

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```
*****
Subroutine CRITDIA                      File BUMPERII.FOR      Line 13784
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H
*****
Subroutine FLUX                        File BUMPERII.FOR      Line 13947
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine FLUX20001                  File BUMPERII.FOR      Line 13970
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine FLUX791                    File BUMPERII.FOR      Line 14065
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Function DEBFLUX                      File BUMPERII.FOR      Line 14125
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, PDF
*****
Subroutine SOLREAD                    File BUMPERII.FOR      Line 14262
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY,
LUXMON, LUXYR
*****
Subroutine FILL                      File BUMPERII.FOR      Line 14355
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine FORMATOUT                  File BUMPERII.FOR      Line 14425
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  60
*****
Subroutine SUPER                      File BUMPERII.FOR      Line 14653
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  70
*****
Subroutine PATRES                      File BUMPERII.FOR      Line 14804
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY, IFL
*****
```



```
*****
Subroutine CONTOUR                      File BUMPERII.FOR      Line 14878
```

USAGE WARNING #127- local variables set but never referenced: CHRDUMMY (Line 15255)

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, PNPS

SYNTAX FYI #138- unused labels: 320

```
*****
Subroutine OPENCTR                      File BUMPERII.FOR      Line 15274
```

```
>     CFILE=ANSWER
>     ^
BUMPERII.FOR:OPENCTR line 15300:
SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).
```

```
>     OFILE1=ANSWER
>     ^
BUMPERII.FOR:OPENCTR line 15301:
SYNTAX FYI #105- string will be truncated (from 80 to 50 chars).
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDUMMY, LLENGTH

```
*****
Subroutine ZERO_C                      File BUMPERII.FOR      Line 15332
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDUMMY

```
*****
Subroutine CINPUT                      File BUMPERII.FOR      Line 15349
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDUMMY

SYNTAX FYI #138- unused labels: 65

```
*****
Subroutine ALTITUDE                    File BUMPERII.FOR      Line 15916
```

```
>     READ ( ANSWER(1:80),215,ERR=172 ) ALT
>     ^
BUMPERII.FOR:ALTITUDE line 16006:
SYNTAX WARNING #46- branch into block if via label 172.
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDUMMY

SYNTAX FYI #138- unused labels: 151

```
*****
Subroutine CINPUT_RANGE                File BUMPERII.FOR      Line 16038
```

USAGE FYI #128- local variables declared but unused: WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRDUMMY

```
*****
```

```

*****
Subroutine INPUT_C_SHIELD                      File BUMPERII.FOR          Line 16121
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_C_MW                          File BUMPERII.FOR          Line 16296
> 360  IF ( IBATCOM.NE.3 ) WRITE ( OU,370 ) LUNITD
> ^
BUMPERII.FOR:INPUT_C_MW line 16368:
SYNTAX WARNING #53- branch to label 360 from outside block if.
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine INPUT_C_VW                          File BUMPERII.FOR          Line 16545
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine CRESOUT                            File BUMPERII.FOR          Line 16712
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine CRESPONSE                          File BUMPERII.FOR          Line 16859
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine LASTOUT_C                          File BUMPERII.FOR          Line 17163
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
SYNTAX FYI #138- unused labels:  314
*****
Subroutine DP_C_OUT                           File BUMPERII.FOR          Line 17225
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine SP_C_OUT                           File BUMPERII.FOR          Line 17287
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine MW_C_OUT1                          File BUMPERII.FOR          Line 17347
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****
Subroutine MW_C_OUT2                          File BUMPERII.FOR          Line 17418
USAGE FYI #128- local variables declared but unused:  WORKSPACE, TCA, CHECKWKSP, DLU, EL, H, CHRUMMY
*****

```

Global checking:

INTERFACE FYI #131- unused functions: PRV

INTERFACE FYI #132- unused subroutines: DEVELOPMENTAL7

USAGE ERROR #133- common block members referenced but not set: /ALL1/SHAPE

USAGE WARNING #134- common block members set but not referenced: /ALL1/SHPV, /ALL1/R, /ALL1/P, /ALL1/AC,
/ALL1/ROTSUM, /ALL1/TC,
/ALL1/M, /ALL1/SPENTFILE, /ALL1/PFSU, /ALL1/PFTU, /ALL2/PNPB, /ALL2/IBEN2RSP, /ALL2/IBEN2SHD,
/ALL2/IBEN2CNTR,
/ALL2/IBEN2BTCH

USAGE FYI #135- unused common block members: /ALL1/VINC, /ALL1/PYSTRN, /ALL1/PCR, /ALL1/LAMBDA,
/ALL1/SIGSQ, /ALL1/SIGMA,
/ALL1/VDIST, /ALL1/RHO, /ALL1/DENSE1, /ALL1/YSTRN1, /ALL1/SOUNDV, /ALL2/PIDC, /ALL2/IPID1,
/ALL2/PRANGE, /ALL2/NPIDR,
/ALL2/ICSTOR, /ALL2/NPIDS

ERROR IN FUNCTION PRV IN BUMPERII version 1.3

8/26/92

To determine the space debris probability distribution for various velocities, the subroutine GAUSS calls an EXTERNAL function PRV using function FUN. The calling line is:

$$SS = SS + W(JLOC) * (FUN(XM+DX) + FUN(XM-DX))$$

BUMPERII version 1.2a used a REAL FUNCTION PRV(VR) where VR was a local dummy variable. However, BUMPERII version 1.3 has no local dummy variable ("REAL FUNCTION PRV"). VR used in the equation is a global variable that is defined elsewhere. The variables in the calling subroutine are not passed to PRV and the equation is evaluated twice at the same velocity. To correct this problem a dummy variable VV was used: REAL FUNCTION PRV(VV) (REAL*4 VV) and VV was substituted for VR in PRV. The effect on SS (unnormalized) is negligible (<1% typically), as shown below. However, in the interest of producing accurate, readable and transportable code, it should be corrected.

Norman Elfer

SS PRV	SS PRV(VV)	NORMALIZED PRV	NORMALIZED PRV(VV)
.0144086	.0180215	.0000899	.0001121
.1284825	.1402788	.0008018	.0008727
.5372956	.5641477	.0033531	.0035097
1.5910326	1.6343143	.0099291	.0101673
3.6521249	3.6982512	.0227916	.0230074
6.7533383	6.7750378	.0421452	.0421486
10.3033609	10.2793999	.0642996	.0639498
13.2417536	13.1801004	.0826370	.0819955
14.7042398	14.6428242	.0917639	.0910954
14.6944132	14.6737270	.0917025	.0912876
14.1340790	14.1635504	.0882057	.0881137
14.1529274	14.1993027	.0883233	.0883361
15.1192284	15.1286840	.0943537	.0941180
16.1793785	16.1188774	.1009697	.1002781
15.7371292	15.6224060	.0982098	.0971895
12.5654869	12.4526300	.0784167	.0774698
6.7313013	6.6803870	.0420076	.0415598
.0000000	.7697615	.0000000	.0047888
.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000

